See letter from G. H. Gabb
84198
No. 38.

THE ROYAL SOCIETY.

SIR FREDERICK GOWLAND HOPKINS,
PRESIDENT.

CONVERSAZIONE

BURLINGTON HOUSE.

May 9th 1934.

REFRESHMENTS IN THE ANTE-ROOM ON THE GROUND FLOOR.

WELLCOME INSTITUTE LIBRARY
Coll. wellMOmec
Coll. pam
No. Q 3
1934
R88c

Descriptive Catalogue.

The descriptions of Exhibits in this Catalogue are supplied by the Exhibitors, who alone are responsible for their accuracy.

ROOM 1.

1. *The National Physical Laboratory.*

Demonstration of part of the apparatus for determining length standards in terms of wave-lengths of light (*Mr. J. E. Sears, Junr., and Mr. H. Barrell*).

The exhibit forms part of a new apparatus which has recently been used to determine the length of the metre and of the yard in terms of wave-lengths of light. Demonstrations will be given of the application of circular interference fringes produced in cadmium radiations to the measurement of an étalon approximately $\frac{1}{12}$th of a metre in length, and of the comparison of optical lengths by means of Brewster's fringes produced in white light passing through this étalon and another one approximately $\frac{1}{3}$rd of a metre long. The measurements can be made either in air or in vacuum.

2. *Professor A. V. Hill, F.R.S., and Mr. D. Scott.*

The Time Relations of the Excitatory Process in Nerve during Continued Stimulation.

It is possible during continued stimulation by condenser discharges, provided at a constant frequency by a commutator, to vary the capacity of the condenser and simultaneously the potential to which it is charged so as to obtain a constant electric response from a nerve. The relation so found between potential and capacity is in principle the same as the usual strength-duration curve. The effect of previous activity, of frequency and of various physical agents upon it can be determined very simply, and the condenser discharge time can be varied as desired down to a millionth of a second. Any nerve, not merely a motor nerve, can be used.

3. *Professor E. G. Coker, F.R.S., and Professor A. V. Hill, F.R.S.*

Some Experiments on Thermo-elasticity.

The adiabatic thermal changes during extension and compression of materials have long been known, but measurement has been difficult. The experiments shown employ a radiation thermopile instead of a contact thermopile for recording the temperature changes. The thermopile is connected to a galvanometer and the thermal effect of loading a specimen can be read on a scale, or recorded photographically, in a few seconds. The method has important possibilities for studying the stresses in structures or models. By using a small thermopile the thermal changes can be fairly accurately located.

Specimens will be shown in a testing machine giving deflections on a scale when stretched. Graphic records of trials of various specimens will be shown.

4. *Professor E. J. Baldes.*

Micro-methods of Measuring Vapour Pressure.

Using A. V. Hill's method of determining vapour pressure with a thermopile of 50 couples of constantan silver, measurements of vapour pressure can be made with 1 c.c. of solution, with an accuracy of 0·2 p.c. It can be shown theoretically that the vapour pressure thermopile, with wires of high thermal conductivity, is inefficient and that similar measurements can be made with a single thermocouple. The demonstration shows the technique of measuring vapour pressures of small drops of liquid (1 mg. or less) suspended from the junctions of a thermocouple. The sensitivity and accuracy are comparable with those of previous methods.

ROOM 2.

(RECEPTION ROOM.)

The Mace of the Royal Society.
Presented by **King Charles II** in 1663.

5. *Dr. C. V. Boys, F.R.S.*

Original Moving Lens Lightning Camera.

This instrument was invented and constructed by Dr. C. V. Boys in the year 1900. The first successful photograph was taken in America at Tuxedo Park in 1928. One other photograph was obtained at St. Marylebone, Andover, in 1931. This instrument, which has just been returned by Dr. Schonland, was used in South Africa for two years, along with other similar cameras for securing a number of photographs.

Photographs obtained with Revolving Lens Cameras.

These photographs include the original one of 1928 taken in America and the one taken at St. Marylebone. The more striking were taken by Dr. Schonland and Mr. Collens in South Africa in March, 1933. From these the whole progress of a lightning flash during the time that it lasts can be determined and its speed measured. If lightning were much faster than light the instrument would still be able to measure its speed. (See paper by Dr. Schonland and Mr. Collens in Proceedings, Royal Society, Vol. A, 143, p. 654 (1934).)

6. *Mr. Henry Balfour, F.R.S.*

Stone Implements of the Natives of Tasmania.

The culture status of the recently extinct Tasmanian natives has, until lately, been underestimated. Some archæologists have, quite erroneously, characterized their culture as " pre-palæolithic," or " eolithic." Others have rightly recognized a middle-palæolithic *facies* and have drawn a comparison with the industry of Moustierian Man in Europe.

The aim of this exhibit is to prove that the Tasmanians had, in reality, advanced considerably further, and that, in addition to the Moustierian types of implements, which are abundant, there is a far larger proportion of tools which, both in type and technique, strikingly correspond with the more characteristic implements of the Aurignacian (late-palæolithic) culture-phase. The so-called *retouche aurignacienne* is both frequent and highly developed.

When judged by their more advanced achievements in fashioning stone implements, the culture of the Tasmanians must, therefore, be correlated with that of Cromagnon Man.

7. *Mr. M. J. D. White.*

The Effects of X-Rays on Chromosomes in Mitosis and Meiosis.

The exhibits consist of material from locusts of various species. Irradiation produces profound disturbances of the cellular physiology which lead to chromosomal alterations which occur over a period of many days following on irradiation. The most frequent of these are breakage and fusion of chromosomes. In this way chromosomes with two, three or even four spindle-attachments are formed. Fragments with no attachments, branched and ring-chromosomes will also be demonstrated. Abnormalities at the second meiotic division in locusts lead to the production of many-tailed sperms.

8. *The John Innes Horticultural Institution.*

Sex Determining Chromosomes in the Rat (*Dr. C. D. Darlington, and Dr. Ch. P. Koller*).

The male rat forms two sorts of spermatozoa, one with a large X chromosome and the other with a smaller Y chromosome in place of it. The Y corresponds with a part of the X, with which it pairs and crosses over in the first of the two divisions which lead to the formation of the germ cells. According to the part of the chromosome in which this crossing-over occurs the X separates from the Y at the first or second division, as is seen in adjoining cells in the preparation. The result of this behaviour will be to give the possibility of partial as well as complete sex-linkage.

New Characters in Diploid and Polyploid Tomatoes (*Dr. F. W. Sansome*).

A change in the chromosome number influences both the dominance and expression of some genes, and the phenotype of the tomato. The effect of polyploidy upon the phenotype varies according to the genetic constitution of the plant.

A Chromosome Deficiency in Oats (*Dr. J. Philp*).

A race of oat plants has been obtained having 41 chromosomes instead of the normal complement of 42. The odd chromosome contains a factor necessary for the production of chlorophyll and this chromosome is only transmitted to the progeny in about 12 per cent. of cases. The progeny of such plants therefore consists of about 12 per cent. of 41-chromosome green seedlings and about 88 per cent. of 40 chromosome albino seedlings. The albino seedlings, having no green chlorophyll, die within a few weeks. Occasionally the odd chromosome is deleted from the somatic tissue of 41 chromosome green plants which then become variegated.

9. *The National Institute for Medical Research.*

Physiological tests for acetylcholine. (*Sir Henry Dale, Sec.R.S., Dr. W. Feldberg, and Dr. A. Vartiainen.*)

Acetylcholine has acquired a growing interest in recent years from evidence of the transmission of excitation at nerve endings and peripheral synapses by its liberation. Demonstrations are given of physiological methods for its detection, depending on its action in extremely low concentrations on isolated muscle of the leech, the frog's heart and the mammalian intestine.

10. *The Marine Biological Association.*

The Axial Skeleton of Teleostean Fishes.

The exhibit forms part of the material for research on the variation of the vertebral column from vertebra to vertebra in the same skeleton, from individual to individual in the same species, and from species to species among Teleostean fishes. The object of the research is to acquire knowledge of the relation of form to function and phylogeny, and to apply the results to the problem of " races " in fishes.

11. *Department of Geology, British Museum (Natural History).*

The Tail and Sensory Canals of the Old Red Ostracoderm *Pteraspis* (*Dr. E. I. White*).

Although shields of the Ostracoderm *Pteraspis* have been known as common fossils in the Lower Old Red Sandstone for over 100 years, until recently no specimen had been found shewing the form of the tail. One of the specimens exhibited, which comprises the external moulds of both dorsal and ventral surfaces, shews not only the tail, which is hypocercal (reversed heterocercal), but also the mouth-parts, never before seen in an English Pteraspid. Other specimens shew the irregular distribution of the main sensory canal system and its connexion with the grooves that form the "ornamentation," and also the growth-stages of the dorsal disc.

Concretions with Spiral Form (*Dr. H. D. Thomas*).

The occurrence of concretions of inorganic origin with a spiral form has hitherto been doubted. Some from the Wealden Beds of Sussex were originally described as the internal casts of a gigantic gastropod, *Dinocochlea ingens* B. B. Woodward. The apex of a specimen of the latter is shown, as well as a series of spiral concretions from the Lower Greensand, the Chalk, the Lower Bagshot Beds, and the Red Crag, which are undoubtedly inorganic, and some of which are newly-discovered. There is much variation in the characters of the spirals, which may be dextral or sinistral, open or closed; a tapering apex is not usual. There is no indication of spiral structure occurring within the concretions; it is limited to the external shape.

12. *Dr. F. Gross.*

Variability, Meiosis and Mitosis in Diploid and Polyploid *Artemia salina.*

In some places the brine shrimp, *Artemia salina*, is found as a diploid bisexual form, in other places only as females with diploid, tetraploid and probably octoploid chromosome number. Experiments with different salt concentrations showed that the resulting variability of the body shape was also associated with the chromosome number, the doubling of the chromosome number acting in the same direction as an increase in salinity. Experiments with cold and chloroform during meiosis combined with cytological studies indicate that polyploidy can be induced in *Artemia* by the suppression of the extrusion of the polar body. Certain cytological evidence on mitosis in *Artemia* has a bearing upon our understanding of the general process.

ROOM 3.

13. *The British Thomson-Houston Co., Ltd.*

Colour Distribution from Modern Gas Discharge Lamps.

Considerable advance has been made in lamp manufacture by the rapid development of high efficiency discharge lamps. The exhibit consists of six cabinets each containing a particular kind of lamp, a set of colours, a spectrogram of the light radiation and electrical data on the lamp. The efficiency and colour distribution of various types of gaseous discharge lamps can be compared with each other and with a standard incandescent filament lamp.

14. *Mathematical Department, Imperial College of Science.*

Fractional Seconds Chronograph (*Mr. E. A. Nehan*).

This instrument is designed to record visibly on paper tape, 1/100ths of a second at 1/10th inch scale, up to four events simultaneously. The 1/100ths second time scale can be divided by estimation to 1/500th of a second easily. A tuning fork controls a synchronous motor, which through a 3-speed gear gives motion to a printing train, and paper feed at the selected speed. Four inking pens record any event, translated as a simple make and break circuit, which mark on the tape is squared down to the time scale, printed on the tape. The machine is portable, self-contained, and worked from a 12-volt accumulator.

Integrator (*Mr. J. Harvey*).

By rolling a horizontal spur wheel on a rack in one direction and moving the rack perpendicularly, the axis of the wheel can be made to trace a curve whose Fourier coefficients are required. The wheel makes n turns over a range of rack representing $0 - 2\pi$. On a horizontal arm fixed to the axle of this wheel, is a wheel which rolls on the paper and registers the coefficients a_n and b_n. Six harmonics can be found. The mechanism is adapted to find area, and first and second moments of area about an axis, on the principle of Amsler's moment integrator.

15. *Professor P. A. Buxton and Mr. A. W. McKenny-Hughes.*

The Bed Bug in the Slums.

The exhibit consists of bed bugs (*Cimex lectularius*, L.), of all stages, fed and unfed; also photographs showing heavy infestations in slum bedrooms. Certain control measures are also illustrated. In many urban areas nearly all houses are infested with bugs, and the insects are being moved from old slums to new estates. This can be controlled by fumigating the furniture in transit. A far greater problem is the control of bugs in old houses which are still occupied. Control must be efficient in a few hours and performed without risk to the human population.

16. *Dr. R. P. Linstead.*

The Phthalocyanines, a New Class of Organic Colouring Matters.

The phthalocyanines are a group of complex organic compounds of the general type $(C_8H_4N_2)_4 . X'_2$ or $(C_8H_4N_2)_4 . X''$, where X′ is hydrogen or univalent metal and X″ is divalent metal. Metallic phthalocyanines are prepared by the action of metals on the dehydration products of phthalamide. Metals such as sodium and magnesium are easily eliminated from the products with the formation of the parent compound. The fundamental structural unit resembles that of the porphyrins, the metal being in the centre of a large ring. The compounds are extremely stable to heat and reagents and can be sublimed at 500–600° C. They form very fast blue to green pigments.

17. *Sir Gilbert Walker, F.R.S. and Mr. A. Graham.*

The Formation of Artificial Clouds.

If a layer of liquid or air at rest is heated below or cooled above, the vertical instability will produce motion in polygonal cells. But if the fluid moves with considerable shear, there will be longitudinal cells parallel to the direction of the shear. It has been found that in air a slow shear produces transverse cells and an intermediate velocity a rectangular pattern. These four kinds of cells will be demonstrated and identified with cloud forms. Cells also occur without cloud formation and are of interest in connection with turbulence and with soaring flight.

18. *Mr. R. C. Brown.*

Methods of Studying Capillary Waves.

Ripples produced on a liquid surface by a point-, or line-source maintained by a valve oscillator are made to appear stationary by intermittent illumination of the same frequency. The interrupted light is produced by reflexion from a mirror attached to a vibrating reed. The frequency is determined by connecting an Osglim lamp across the oscillator output and allowing this to illuminate a stroboscopic disc controlled by a 50-cycle tuning fork. Thus measurements of wavelength and amplitude can be made over a range of frequency, the validity of Kelvin's equation tested, and surface tensions measured. It is also shown that a liquid surface over which ripples are passing may be used as a plane reflecting diffraction grating for visible light.

19. *The Director, Royal Botanic Gardens, Kew.*

Method of Grafting the "Glory Pea" (*Clianthus Dampieri* A. Cunn.).

Clianthus Dampieri is grafted on to seedling stock of the bladder senna, *Colutea arborescens*, when both scion and stock are quite small seedlings. The growing shoot is removed from between the cotyledons of the stock, and the swollen hypocotyl is split with a razor. The seedling *Clianthus*, cut to fit, is inserted into the slit and secured in position with a strand of cotton or raffia. The two quickly unite in a warm propagating case.

20. *Professor R. C. Punnett, F.R.S.*

Evolution in the Budgerigar under Domestication.

The Budgerigar (*Melopsittacus undulatus*) has been domesticated in Europe for rather less than a century. During that time various sports have appeared, *e.g.*, diminution of melanic pigment leading to the formation of pale forms; loss of the yellow ground colour giving rise to a series of blue forms corresponding to the various green ones. The genetical relations of these mutational forms have been worked out by several observers and are illustrated in the exhibit. The species offers the only instance in a vertebrate of the changes undergone by a *known* wild form under conditions of domestication.

ROOM 4.

(PRINCIPAL LIBRARY.)

21. *The Science Museum.*

Reproduction of Cayley's First Model Glider, 1804.

This represents the earliest recorded experiment in free flight with an "aeroplane" or gliding machine having both vertical and horizontal "rudders." The reproduction is based upon a sketch and description contained in Sir George Cayley's Notebook (*circa* 1799–1826).

The essential description of the device is as follows :—

> "A common paper kite containing 154 square inches was fastened to a rod of wood at the hinder end and supported from the fore part from the same rod by a peg, so as to make an angle of 6°. With it this rod proceeded on behind the kite and supported a tail, made of two planes crossing each other at right angles, containing 20 inches each. This tail could be set to any angle with the stick. The ratio about 5 square feet of surface to the pound—velocity 10 miles per hour."

See : Notebook (*c.* 1799–1826) of Sir George Cayley, Newcomen Society Extra Publication No. 3, 1933 ; reprinted in *The Aeronautical Journal*, June, 1933.

Reproduction of Cayley's Improved Aerial Top, 1854.

This is an exact copy of the "Improved Chinese Flying Top"—a device which serves to illustrate the principle of the lifting airscrew—which was made and used by Sir George Cayley for his early experiments in regard to mechanical flight.

It consists of three thin metal vanes set (in this case), at an angle of about 25° to the plane of rotation and mounted on a vertical spindle which rests freely in a wooden holder. The upper part of the front or leading portion of each vane is cut away in order to obtain a fine entering edge—a significant feature of this model airscrew. The method of operation was to rotate the spindle rapidly in the holder by means of a cord wound round it, when the airscrew would rise to a considerable height thus demonstrating the principle of the helicopter.

See : "Description of an Improved Chinese Flying Top," now in the Library of H.M. Patent Office.

22. *The Forest Products Research Laboratory.*

A Photoelectric Method of Measuring the Cell Space Ratio in Woods.

The cell space ratio, or the ratio of the void volume to the total volume, of a piece of wood may be obtained photo-electrically. The quantity of light transmitted by a suitably stained micro-section of the wood is measured as a percentage of the total quantity of light falling on the section, a correction being made for the partial transparency of the stain on the section. By adjusting the magnification of the projected image of the section, measurements may be made either on an integral number of annual rings, giving an average value of the cell space ratio, or on a small area confined to the spring or summerwood separately.

23. *Dr. F. G. Gregory and Mr. H. L. Pearse.*

A Self-recording Apparatus for Measuring Changes in Aperture of Stomata of the Leaf.

A glass cup attached to the lower side of the leaf by means of a gelatine washer is connected in series to a constant pressure aspirator through a variable capillary resistance, and air is thus drawn through the stomata. The pressure between the leaf and the resistance is recorded by a manometer, the varying level in which interrupts a beam of heat focussed on a linear thermopile Variation in stomatal aperture is traced by a recording millivoltmeter.

24. *The National Physical Laboratory.*

An Analogy of the Aurora Borealis demonstrated by means of a Cathode-Ray Tube (*Mr. R. A. Watson Watt*).

A jet of electrons is directed towards a magnetic model of the earth. The deflection experienced by the jet under the influence of the magnetic field illustrates some of the processes of the aurora.

The Cathode-Ray Tube as Magnetic Compass (*Mr. R. A. Watson Watt, Mr. J. F. Herd, and Mr. L. H. Bainbridge-Bell*).

A cathode-ray beam is deflected by the earth's magnetic field and may therefore be used as a compass needle free from inertia. In the present instrument light signals controlled by collector electrodes in the tube indicate any change in the magnetic bearing of the platform carrying the tube. Changes of a small fraction of a degree can be indicated.

25. *The Metals Research Association.*

Control of Structure and Soundness of Ingot of Non-Ferrous Metals.

(*a*) *Effect of Casting Conditions on Brass Ingots.*—The exhibit will illustrate the influence of ingot size, composition and pouring conditions on ingot soundness and structure. Particular reference to the effect of turbulence due to penetration of stream and the use of volatile mould coatings, and avoidance of turbulence by use of the Durville (still) casting process.

(*b*) *Unsoundness in Aluminium Alloy Castings: Causes and Remedies.*—The exhibit illustrates (1) Causes of contamination by gases, which are responsible for defects known as "pinholes."

(2) Methods for overcoming these troubles, including treatment of the melt prior to casting by various degassing processes, and by solidification under pressure.

(3) A study of gas-metal relationships with particular reference to the solid oxide film which is present in molten aluminium.

26. *Metropolitan Vickers Electrical Company, Ltd.*

Metropolitan-Vickers Portable Noise Measuring Apparatus.

This apparatus enables sustained noises of any type to be measured on the aural balance principle. It consists essentially of a valve oscillator, a calibrated attenuator and a telephone earpiece. The oscillator generates current at 800 cycles which is fed to the telephone through adjustable attenuators. One of these covers a range of 0 to 100 decibels, in steps of 5 decibels, and the other gives a continuous variation of 10 decibels. The apparatus is calibrated so as to indicate directly the intensity of the 800 cycle tone in the telephone in decibels above threshold of 0·0003 dynes/sq. cm., measured in the ear or 0·00021 dynes/sq. cm., measured in free space. The observer places the telephone on one ear and presents the other to the complex noise to be measured. He then adjusts the attenuators until he judges the loudness of the 800 cycle note heard in the telephone to be equal to that of the complex noise. The equivalent value of the complex noise is then read in decibels above threshold from the settings of the attenuators.

Metallic Coatings on Glass and Paper, obtained by the Condensation of Metal, Evaporated *in vacuo*.

Aluminium coatings so obtained have very good reflecting properties and do not tarnish readily. Consequently they are especially suitable for use in optical work.

27. *The Entomological Department, Rothamsted Experimental Station.*

Investigations on the Relation of Insect Activity in the Field to Climatic Conditions (*Mr. C. B. Williams, Chief Entomologist, and Mr. D. Morland, Apiarist*).

A light trap, which catches and kills the insects attracted to it at night and sorts them into eight groups according to the time of night at which they enter, has been in continuous use at Rothamsted for over one year. The captures are correlated with various weather conditions including temperature, wind, humidity, the cloudiness of the sky and the duration of moonlight. Instruments for recording the two latter are also exhibited. For studying activity during the day a bee hive is kept on a recording weighing machine and the changes in weight and number of hours activity obtained from this are also being correlated with weather conditions.

28. *Messrs. Adam Hilger, Ltd.*

Apparatus for Spectrography and Spectrophotometry.

1. *The Hilger Non-Registering Microphotometer.*—This instrument is designed for the measurement of the density of individual lines on a spectrogram for (*a*) Quantitative Spectrum Analysis, (*b*) Spectrophotometry or (*c*) X-ray Analysis. A narrow pencil of light transmitted through the spectrum plate passes via a narrow slit on to a photoelectric cell the currents in which are read directly on a galvanometer. It is shown set up for determining the match points on absorption spectrograms.

2. *Fluorite Vacuum Spectrophotometer.*—A combination of a small fluorite spectrograph and a modified form of Spekker Photometer with light source enclosed in a vacuum chamber. It is intended for the extension of absorption measurements beyond the region available to quartz spectrographs.

3. *The Hilger Vitameter A.*—A device for controlling the production of fish liver oil products with respect to their Vitamin A contents. It provides a visual, rapid means of determining the absorption of materials in the neighbourhood of 3280 A.

29. *The Fuel Research Station.*

(*a*) Studies of Coal Particles.

The exhibit illustrates some of the results obtained in an examination of the influence of type of mill and type of coal upon the nature of powdered fuel. The influence upon (*a*) size distribution; (*b*) shape of particle; (*c*) distribution of petrographic constituents is shown in the case of three mills using three different types of coal in each. The results are shown by means of graphs, photomicrographs and actual specimens.

(*b*) Studies of Coal Suspensions.

In general, for the same number of heat units, coal is much cheaper than oil, but a liquid fuel possesses the advantage arising from the ease with which it can be transported through pipelines and the facilities it offers for making the best use of the available storage space. These advantages may be combined by preparing a mobile suspension of finely pulverised coal in oil. The main difficulty in preparing such a fuel is to ensure that it shall be stable, *i.e.*, that no appreciable settling out of the coal shall occur during the necessary period of storage. The exhibit illustrates the methods of attaining this stability.

30. *The Building Research Station.*

Piezo-electric Recorder for Impact Stresses (*Mr. G. Grime*).

In a study of the effect of impact during the driving of reinforced concrete piles, a knowledge is required of the stresses actually developed in a pile. A transportable apparatus has been devised for recording the transient strains in a manner which enables such stresses to be estimated. A gauge incorporating a piezo-electric crystal is cast in the pile and the potential developed by the crystal is amplified and applied to a cathode ray oscillograph with a linear time-base. Photographic records are obtained.

31. *Mr. R. W. Paul.*

Simple Apparatus for Prolonged Artificial Respiration.

For eight months past similar apparatus has provided respiration in a case of muscular atrophy. At the suggestion of Sir William Bragg pressure is rhythmically applied to an air-bag strapped on the thorax. A small, transportable machine (pulsator) supplies a definite air pressure. The original pulsator is working on town water supply. If electricity is available the form here shown in conjunction with its control box is preferable. Normally the air-bag nearly encircles the bony thorax below the armpits and has a non-extensible outer skin. It is comfortable and its action is unaffected by the posture or change of position of the patient. X-ray photographs illustrate the anatomical displacements involved.

32. *The Strangeways Research Laboratory.*

The Nature of the Active Principle of the Amphibian Organisation Centre (*Mr. C. H. Waddington, Dr. J. Needham, and Dr. D. M. Needham*).

It has been found that the activity of the organisation centre of the amphibian egg, which controls the formation of the axial embryonic organs, is due to an ether-soluble substance, which is probably unsaponifiable. Sterols (cholesterol, phytosterol, calciferol, oestrol) cause a proliferation without differentiation of the ectoderm, and similar effects, grading into true inductions, are obtained with the carcinogenic hydrocarbon 1.2.5.6. Dibenzanthracene. (Exhibited in collaboration with the Sir William Dunn Institute of Biochemistry, and the Department of Experimental Zoology, Cambridge.)

The Relation between Differentiation and Chemical Processes in the Early Development of the Bird and Mammalian Embryo (*Dr. W. Jacobson*).

The specimens illustrate the distribution of glycogen in the three germ-layers of fowl and mammalian (mouse) embryos, its disappearance during the formation of mesoderm in the primitive streak, its different distribution within the cell in different regions of the neural groove correlated with the differences of growth rate which cause the closure of the neural tube, and its formation in those entoderm cells which are actively digesting yolk. Other specimens illustrate the distribution of fat and the role of degeneration with the accompanying resorption of particles containing nuclein acid.

A Phenomenon Resembling Fibrillation in the Heart of the 2–3 day Chick, Embryo cultivated in Vitro (*Dr. P. D. F. Murray*).

Entire hearts of chick embryos cultivated in plasma continue beating, more or less normally, for a number of days. If, however, the medium contains a heavy excess of potassium, calcium or magnesium the cells show rapid contractions without co-ordination. In excess calcium and magnesium the co-ordinate beat may continue and the cells then alternately take part in the normal beat and, in intervals between the beats, maintain active unco-ordinated contractions of small amplitude. Between this phenomenon and fibrillation in the mammalian heart there is considerable superficial resemblance, but whether the two forms of activity are fundamentally identical remains doubtful.

A Method for Observing the Growth and Differentiation of the Blood Vessels of the Area Vasculosa of the Chick Blastoderm (*Mr. A. F. W. Hughes*).

Chick blastoderms are grown *in vitro* by means of a technique which permits of their cultivation from the stages of two to four days. A saline Indian ink, dialysed free of toxic substances, is injected into the vessels of such blastoderms in cultivation by means of a micromanipulator. The ink particles are phagocytosed by the vessel endothelium in such a way that a ring of carbon particles surrounds each endothelial nucleus. Under low magnifications the vessels are sufficiently distinct from their surroundings to enable their growth to be watched, while somewhat higher magnifications reveal the part played in vessel growth by the endothelial nuclei as shown by the perinuclear rings.

33. *The National Institute for Medical Research.*

A Microscope for Ultra-Violet Microscopy (*Mr. J. E. Barnard, F.R.S.*).

To obtain ultra-violet photo-micrographs, particularly of virus bodies, it is necessary that the optical parts of the microscopes used should be interchangeable. Two such instruments, one for visual and the other for ultra-violet photography, are shown in which this principle is embodied. The demonstration of a virus will be attempted.

34. *Sir Robert Hadfield, Bt., F.R.S.*

Specimens of Metallurgical Interest, illustrating Properties and Applications of Metals and Alloys, mainly Ferrous.

1. Tested specimens illustrating the minuteness of the explorations of the hardness of metals and alloys made possible by the use of the diamond pyramid hardness test.

2. Series of specimensr epresenting stages in the diamond pyramid hardness scale, from lead (D.P.H. No. 4) to tungsten carbide (D.P.H. No. 1500).

3. The critical influence of temperature in the development, by deformation, of magnetic properties in the austenitic and non-magnetic steel containing 18 per cent. of ohromium and 8 per cent. of nickel.

4. Structural characteristics of an alloy of iron, chromium, tungsten and aluminium, associated with its behaviour in cold drawing.

5. Surface magnetic effects in manganese steel, caused by decarburisation in heating during manufacturing processes.

6. Photomicrographs illustrating the microstructure of a worn stone crusher jaw of manganese steel, continuously from the surface inwards to a depth of 15·5 mm.

Even at the working surface where the deformation is greatest, and hardness and resistance to abrasion are developed to the fullest extent, the steel retains its austenitic character.

7. An alloy of nickel, cobalt and iron, possessing comparatively low and uniform thermal expansion over the range from room temperature to 600° C.

8. Specimens illustrating the development of materials for metal cutting tools, and the steady increase in their performance.

9. Flange bolts of " Era 131 " steel containing molybdenum, which have successfully withstood for 2½ years the severe service demanded in the steam pipe line of an installation working at the high temperature of 875° F. (470° C.) and pressure of 625 lbs. per square inch.

10. Determination of internal stresses in the head of a rail.

11. Portrait Gallery of 120 distinguished scientists connected more particularly with the development of Metallurgy and Engineering.

35. *The Department of Comparative Anatomy and Zoology, Cambridge, and The Cambridge Instrument Co. Ltd.*

The Development of the Automatic Microtome.

The first suggestion of an automatic microtome originated with W. H. Caldwell, of Cambridge, in 1882. He discovered that if objects were embedded in hard paraffin wax, and the block was given a surface coating of soft paraffin, consecutive sections adhered on their edges to one another, so that they could be cut in a long continuous ribbon. R. H. Threlfall, then an undergraduate at Cambridge, co-operated with Caldwell in the construction of what was the first automatic microtome, Threlfall being responsible for the mechanical design. The original instrument made in the Engineering Laboratory at Cambridge is exhibited, and sections of 2·5μ in thickness may still be cut with it. In 1885 Horace Darwin, in consultation with Caldwell and Threlfall, devised the well-known "Cambridge Rocking Microtome." During the fifty years since it was introduced the instrument has undergone various modifications, although it has not been altered in any fundamental point. Instruments showing the progressive modifications, and some of the recent developments, are exhibited.

36. *Department of Mineralogy, British Museum (Natural History).*

Silica-glass from the Libyan Desert (*Dr. L. J. Spencer, F.R.S.*).

This material was recently discovered by Mr. P. A. Clayton during the work of the Egyptian Desert Surveys in the unexplored region bordering on Italian Cyrenaica, about 500 miles S.W. of Cairo. Wind-worn lumps up to 10 lb. in weight were found scattered on the surface between the sand-dunes over an area of 80 by 25 kilometres. Some artificially worked flakes were also found. The material is a nearly pure silica-glass containing SiO_2 97·58 per cent. It is pale greenish-yellow in colour and usually quite transparent, and when cut and polished it makes quite an effective gemstone. One of the cut stones exhibited is lent by Mrs. S. L. Courtauld.

No evidence was obtained on the spot to explain the origin of this silica-glass. It is quite distinct from the fulgurites formed by lightning. It resembles most closely the still problematical tektites; while the presence of a trace of nickel suggests a relation to the silica-glass found around meteorite craters.

37. *Dr. W. R. Jones.*

Silicosis.

Microscope slides showing sericite fibres (1) in sections of silicotic lungs; (2) in mineral residues obtained from silicotic lungs; (3) in rocks and substances which gave rise to the dangerous dust.

38. *Mr. George H. Gabb.*

The earliest known Dated Optical Instrument in the World. A telescope of 1646 by Maria de Rheita.

Maria de Rheita (1597–1660), a Capuchin Bohemian monk whose name was Antonius V. Schyrle before his monastic conversion, was the first to invent a terrestrial telescope with an image-erecting eyepiece of three lenses. Its construction is described by Rheita in his folio work, "Oculus Enoch atque Eliæ," published in 1645, a copy of which is in the library of the Royal Society.

No example of his telescopes was known to have survived until the recent discovery of the one now exhibited.

The body and its five draw-tubes are entirely made of paper; only the cells which carry the object glass and eye lens are made of wood.

On the body, stamped in blind tooling, is the monogram "M.R.," supported by two palm branches, below an eight-pointed star, possibly symbolical of the Eight Beatitudes; and on the third tube, signed in ink, now faded, may be deciphered "Ao. 1645–6 · M.R" · v.e. "Anno 1646 · Maria Rheita."

Its measurements are: Length of telescope when open to focus, 6 feet 6 inches; when closed, 22⅞ inches. Diameter of body, 2 inches. The magnification is about 21, with a field of view of 0° 56′. Its total weight is only 18¾ ounces.

The optical construction is as follows:—

	Diameter.	*Focal length.*	*Effective aperture.*
	Inches.	Inches.	Inches.
Eye-lens	1·26	2·30	1·12
1st Erector lens ...	1·16	3·40	1·06
2nd „ „ ...	1·16	3·84	1·06
Object glass ...	1·30	59·00	0·81 clear aperture.

The aperture ratio of the object glass is 73. The first erector lens is equi-convex, the second lens nearly so.

The telescope is in perfect and original condition, and now in the Gabb Collection.

I wish to thank Mr. D. Baxandall, of the Science Museum, for his assistance in the identification of this instrument.

A diagrammatic model by George Adams, *circa* 1780–90 to show the optical construction of a four-lens telescope, is also exhibited.

39. *The Strangeways Research Laboratory.*

(For full descriptions *see* No. 32.)

40. *The National Institute for Medical Research.*

The Virus of Psittacosis in Stained Preparations, and Cytoplasmic Inclusions in Virus Diseases (*Capt. S. R. Douglas, F.R.S., Mr. P. P. Laidlaw, F.R.S., and Professor W. Levinthal*).

The virus of Psittacosis can be seen in suitably stained specimens as a minute cocooid microorganism, with a definite tendency to pleomorphism. The size of the smallest of the organisms visible in such specimens has been estimated as from 0·2 to 0·4μ, corresponding to the determination by selective filters of the smallest infective units, at from 0·2 to 0·33μ.

Cytoplasmic inclusions are bodies found in the protoplasm of infected cells in certain virus diseases. According to recent evidence they appear to contain infective units of the virus closely aggregated in a matrix. The specimens shown are from animals infected with Canary pox and Dog distemper.

41. *Mr. F. G. Walton Smith.*

Developmental stages of the Common Limpet, *Patella vulgata.*

Since the investigations of Patten in 1885, which did not extend beyond the stage of larval torsion, there have been no successful attempts to rear the larvæ of Patella. The exhibits illustrate the larvæ and post-larvæ of P. vulgata reared during the last two years. The larva is a fairly typical marine gastropod veliger, with a nautiloid shell. At metamorphosis the adult shell develops as a fringe or peristome to the larval shell, which remains perched like a cap on the top of the former, until finally cut off by constriction of the mantle.

42. *Department of Entomology, British Museum (Natural History).*

The British Myrmecophiles. (Guests of British Ants.) (*Mr. H. Donisthorpe*).

A cabinet drawer containing complete set of the Guests of British Ants, together with their hosts.

A colony of *Myrmecina graminicola* Latr.; has been kept in captivity for 24 years. On May 1, 1910, the colony consisted of a queen, a very few workers, eggs and young larvæ. They were nesting in a hollow flint; Box Hill, Surrey.

Small colony of *Stenamma westwoodi* West., nesting under stone, Mount Garret Wood, Wexford, May 20, 1921. The queen is over 13 years old.

Compound colony of *Leptothorax nylanderi* Först. (1). A queen, workers, and brood taken under bark of oak, Windsor Forest, June 13, 1933. (2) Two queens, workers, and brood nesting in fungus (*Daldinia concentrica*), Southampton; introduced into nest January 1, 1934. After some fighting the colonies combined.

43. *Professor H. Graham Cannon.*

Thick Sections of Animal Tissues.

Sections cut as thick as 250μ are of great value in studying the anatomy of animals, especially of Crustacea. A wet celloidin method is used and the sections are stained individually. Such thick slices show large pieces of limbs with all the setal armature held in position by the transparent celloidin, and are of much greater use in settling the details of complicated arrangements than are sections of ordinary thickness. Small vertebrates may be treated similarly, but the ordinary paraffin method can be used. Sections obtained by both methods are exhibited.

GROUND FLOOR.

(END OF CORRIDOR.)

ROOM 5.

44. *Dr. M. L. Oliphant.*

Transmutation Experiments with Protons and Diplons at Potentials up to 100,000 volts.

A demonstration of transmutation effects observed when protons and diplons are used to bombard layers of lithium and of heavy hydrogen. The emission of α-particles and of protons, and the methods of detecting them, will be demonstrated. The high tension apparatus is supplied by Messrs. Watson & Co.

45. *Dr. C. D. Ellis, F.R.S., and Mr. W. J. Henderson.*

Induced Radioactivity of the Light Elements.

The experiment shows the production and decay of the new radioactive elements discovered by Joliot and Curie. These elements are produced here by the action of the α-particles from radium active deposit. In the case of aluminium, the action is believed to be $Al^{27}_{13} + He^{4}_{2} \rightarrow P^{30}_{15} + n^{1}_{0}$, the neutron being ejected at once. This new isotope of phosphorus decays with a period of about 3 minutes, emitting positrons and forming Si^{30}_{14}. Analogous phenomena are shown using Boron, Nitrogen and Magnesium. Simple experiments are shown to demonstrate the nature of the emitted radiation (positrons).

ROOM 6.

(MEETING ROOM.)

46. *The Director of Scientific Research, Admiralty.*

Air Flow Meter.

The displacement of a diaphragm in an air stream causes an iron armature to move towards one coil and away from another, thereby throwing an A.C. bridge out of balance. The "out of balance" is recorded through a full wave rectifier on a permanent magnet moving coil instrument calibrated in ft./min.

Prevention of the Oil Pollution of the Sea.

The exhibit is designed to illustrate the advances made by the Admiralty Chemical Service in combatting the Oil-pollution of the sea.

The process, although only a secondary step in the main problem, is of vital importance to the Service and the Mercantile Marine in general.

It is, so far, the only practical means of dealing with the emulsified oil recovered by ships' separators and makes possible the salvage of the oil in a serviceable condition.

Heretofore the emulsified oil from the separators was not only unburnable, but its destruction or disposal in any manner whatsoever was an unsolved problem. The exhibit shows :—

(i) the emulsion.

(ii) the low temperature carbonisation creosote used to break the emulsion.

(iii) the separation into quantitative layers of oil and water.

(iv) the recovered oil mixture free from water and ready for use.

An Apparatus to enable the Deaf to Hear by Bone Conduction.

Amplified currents from a microphone are supplied to a coil wound direct on to a straight nickel iron wire which has a high magnetostriction coefficient. The wire vibrates with the frequency of the current and the vibrations may be transmitted to the cochlea through the bones of the head or jaw either by clenching the wire in the teeth or by pressing it on the mastoid bone behind the ear.

The Effects of Mechanical Strain on the Properties of Magnetic Materials.

Changes brought about in ferromagnetic materials by the application of mechanical strain resulting from tension, pressure or torsion are demonstrated with the aid of a cathode ray oscillograph.

Piezo Electric Records of Underwater Explosions.

Records are exhibited of the pressure-time curves of the pressure pulse from underwater explosions, measured in terms of the charge developed in a tourmaline crystal subjected to the pressure and recorded by a Cathode Ray Oscillograph.

The exhibit includes records of the pulses from normal charges and from charges in thick containers and in air spaces.

The reflected pulses from the surface and sea bottom are also shown.

Oscillations set up in the crystal under the impact of the pulse are visible in some records. From these the velocity of the pulse in tourmaline has been determined.

Automatic Radio Direction Finder.

A direction finder of Bellini-Tosi type comprising two crossed frame coils and a goniometer, the search coil of which is rotated by an electric motor. The goniometer is connected to a radio receiver followed by a special rectifier and relay system which reverses the direction of the electric motor whenever the high frequency current in the search coil increases; thus, since the direction of rotation of the search coil is reversed whenever the minimum is passed, the search coil hunts a position at minimum. A small local oscillator is used to provide the incoming wave for exhibition purposes.

Marine Galvanometer.

The galvanometer has a resistance of 100 ohms, and a scale sensitivity of 16 millimetres per microampere. When used in a circuit of 100 ohms external resistance the zero holds within a few millimetres under conditions of violent pitching and rolling. This immunity from mechanical disturbance of the zero, has been secured by the use of

(*a*) an extremely light coil (mass = 0·4 gram),

(*b*) a very powerful magnetic field (10,000 gauss),

(*c*) short taut suspensions (each suspension is 0·1 in. long and stretched to $\frac{1}{3}$rd the breaking load),

(*d*) accurate balance.

47. *Professor G. I. Finch.*

Electron Diffraction and Surface Structures.

I.—Precision Electron-Diffraction Camera designed by Professor Finch and Dr. Quarrell in conjunction with the Research Staff of I.C.I. (Alkali), Ltd., and constructed in the Workshops of the Winnington Laboratories.

II.—Electron Diffraction Patterns showing

(*a*) Uniformity of focussing field in planes normal to the beam axis.

(*b*) Effects of non-uniform fields.

(*c*) Basal plane pseudomorphism.

(*d*) The Beilby layer.

(*e*) Structures of some platinum compounds.

(*f*) Structure of zinc oxide films.

48. *Imperial Chemical Industries (Alkali), Ltd.*

Experimental Apparatus from the Research Laboratories.

(1) Electron Diffraction Camera designed by Professor Finch and Dr. Quarrel in conjunction with the Research Staff of I.C.I. (Alkali), Ltd., and constructed in the workshops of the Winnington Laboratory of the Company.

(2) High Temperature Reaction Furnace used in the work on the decomposition of nitrous oxide.

(3) Experimental Bourdon Tube for pressures up to 6,000 atmospheres.

(4) Small Autoclave for work at 3,000 atmospheres and 350° C.

49. *Standard Telephones and Cables, Ltd.*

The Noise Meter exhibited measures the loudness of noise by a subjective method using an off-set receiver and complex wave reference tone, the level of which can be adjusted by means of an attenuator until the masking point is found.

50. *The National Physical Laboratory.*

A Soap-Bubble Gas Flowmeter (*Dr. G. Barr*).

The rate of flow of a stream of gas is measured by making the gas move a film of soap solution along a horizontal burette, and timing the movement of the lamella between two graduations. For low rates of flow the meter has the merit of introducing only a small back-pressure. The flow-meter is thus particularly suitable for measuring the rate of escape of a gas.

51. *Mr. J. D. Bernal.*

X-ray Photographs of Crystallised Pepsin.

These photographs were taken of a crystal of pepsin from Professor Svedberg's laboratory which was examined mounted in its mother liquor in a capillary tube. The pattern shows a hexagonal cell approximately $67 \times 67 \times 140$ Å containing 12 molecules of molecular weight 36,300 practically identical with that derived from ultracentrifuge sedimentation. The nature of the photograph shows that the molecules in the crystal are real and separated by regions of low density, presumably water.

PRINTED BY
HARRISON AND SONS, LTD.,
44–47, ST. MARTIN'S LANE,
LONDON, W.C. 2.